Chapter Four
AIRPORT DEVELOPMENT ALTERNATIVES

Chapter Four

Airport Development Alternatives

Prior to defining the development program for San Manuel Airport, it is important to consider development potential and constraints at the airport. The purpose of this chapter is to consider the actual physical facilities that are needed to accommodate projected demand and meet the program requirements as defined in Chapter Three, Facility Requirements.

In this chapter, a series of airport development scenarios are considered for the airport. In each of these scenarios, different physical facility layouts are presented for the purposes of evaluation. The ultimate goal is to develop the underlying rationale that supports the final master plan recommendations. Through this process, an evaluation of the highest and best uses of airport property is made while considering local goals, physical constraints, and appropriate federal airport design standards, where appropriate.

Any development proposed by a master plan evolves from an analysis of projected needs. Though the needs were determined by the best methodology available, it cannot be assumed that future events will not change these needs. The master planning process attempts to develop a viable concept for meeting the needs caused by projected demands through the planning period.

The number of potential alternatives that can be considered can be endless. Therefore, some judgment must be applied to identify the alternatives that have the greatest potential for implementation. The alternatives

presented in this chapter have been identified as such.

The alternatives presented in the chapter have been developed to meet the overall program objectives for the airport in a balanced manner. Through coordination with the Planning Advisory Committee (PAC) and Pinal County, the alternatives (or combination thereof) will be refined and modified as necessary to develop the recommended development program. Therefore, the alternatives presented in this chapter can be considered a beginning point in the development of the recommended master plan concept and input will be necessary to define the resultant plan.

While the focus of the analysis summarized in this chapter is identifying future development options for San Manuel Airport, it is also important to consider the impacts of alternatives to developing San Manuel Airport to meet future demands. These include: 1) no future development at the airport (no action alternative); and 2) transferring aviation demand to another airport.

The "no action" alternative essentially considers keeping the airport in its present condition and not providing for any type of improvement to the existing facilities to accommodate future demand. The primary results of this alternative would be the inability of the airport to satisfy the projected aviation demands of the airport service area and derive additional revenues through the development of viable parcels of land.

The airport's aviation forecasts projected future growth in based aircraft and aircraft using San Manuel Airport. The analysis of facility requirements indicated a potential need for a lengthened runway, lengthened and widened parallel taxiway, an instrument approach procedure, airfield lighting, expanded fuel storage, and expanded hangar facilities. Without these improvements to the airport facilities, regular and potential users of the airport will be constrained from taking maximum advantage of the airport's air transportation capabilities. Pinal County would also not be able to accrue new revenues from the development of new facilities which can support the operational costs of the airport.

Not improving San Manuel Airport to meet existing and future needs is also inconsistent with the *Arizona State Aviation System Plan* (SANS). San Manuel is classified as a secondary airport in the SANS. This classification denotes the importance of San Manuel Airport to the state airport system. The effectiveness of the state airport system can only be enhanced if San Manuel Airport fully meets the needs of its users and state development standards.

The unavoidable consequences of the "no action" alternative would involve the airport's inability to attract new users, especially those businesses and industries seeking locations with adequate and convenient aviation facilities. Without regular maintenance and additional improvements, potential users and business for the local area could be lost. To propose no further

development at the airport would be inconsistent with local community goals to expand the economic development in Pinal County. Corporate aviation plays a major role in the transportation of business leaders. Thus, an airport's facilities are often the first impression many corporate officials will have of the community. If the airport does not have the capability to meet hangar, apron, or airfield needs of potential users, the airport's capabilities to accommodate businesses that rely on air transportation will be diminished. As detailed in Chapter Two, Aviation Demand Forecasts, corporate aviation is becoming an increasingly larger portion of total general aviation activity regionally, nationally, and at San Manuel Airport.

Transferring aviation services to another airport essentially considers limiting development at San Manuel Airport and relying on other airports to serve aviation demand for the local area. A review of regional airports indicates that there is only one public use airport within 30 nautical miles of San Manuel Airport: Kearny Airport. Kearny Airport provides a paved runway. With a runway length of only 3,400 feet, Kearny Airport cannot serve the mix of aircraft that can use the 4,214 feet of runway length available at San Manuel Airport. Considering the current capability of these airports, neither of these airports is presently configured to serve the existing mix of aircraft serving San Manuel Airport without significant investments.

Other public use general aviation airports are more than 30 nautical miles from San Manuel Airport. Marana Northwest Regional Airport is the closest and is 32 nautical miles west. Tucson International Airport and Ryan Airfield serve the Tucson metropolitan area and are located 35 nautical miles and 40 nautical miles southwest, respectively. Pinal Airpark Airport is located 35 nautical miles west. While each of these airports has comparable or superior airfield facilities and could theoretically accommodate the demand from San Manuel Airport, each of these airports has a role to fill in the regional and national aviation system. Accommodating demand from San Manuel Airport could potentially reduce the long term ability of these airports to meet their future demand levels.

Additionally, each of these airports is a considerable distance from the primary communities that San Manuel Airport serves (Oracle, Mammoth, San Manuel). These airports would not be in a good position to serve these communities due to the extended drive times from these airports to the communities served by San Manuel Airport.

As new industries in the community begin to emerge and existing businesses expand, there will be a need for a highly functional airport. This is demonstrated by the existing corporate users of San Manuel Airport. General aviation plays an important role in the way companies conduct their businesses. San Manuel Airport is expected to contribute to economic

development of the area by serving the general aviation needs of southeastern Pinal County, northeastern Pima County, southwestern Graham County, and northwestern Cochise County.

As detailed in Chapter Two, San Manuel Airport is used by a number of governmental agencies as well. Considering the existing private, corporate, and governmental users that rely on San Manuel Airport, the airport cannot be easily replaced by another airport and must be improved for the betterment of its existing and future users.

AIRPORT DEVELOPMENT OBJECTIVES

It is the overall objective of this effort to produce a balanced airside and landside complex to serve forecast aviation demands. However, before defining and evaluating specific alternatives, airport development objectives should be considered. As owner and operator, Pinal County provides the overall guidance for the operation and development of San Manuel Airport. It is of primary concern that the airport is marketed, developed, and operated for the betterment of the community and its users. With this in mind, the following development objectives have been defined for this planning effort:

- Develop a safe, attractive, and efficient aviation facility in accordance with applicable federal, state, and local regulations.
- Identify facilities to efficiently serve general aviation users.
- Identify the necessary improvements that will provide sufficient airside and landside capacity to accommodate the long term planning horizon level of demand of the area.
- Maintain and operate the airport in compliance with applicable environmental regulations, standards, and guidelines.

The remainder of this chapter will describe various development alternatives for the airside and landside facilities. Within each of these components, specific facilities are required or desired. Although each component is treated separately, planning must integrate the individual requirements so that they complement one another.

Exhibit 4A summarizes the primary planning issues for this analysis. These issues are the results of analyses conducted previously in Chapter Two, Aviation Demand Forecasts, and Chapter Three, Aviation Facility Requirements. These issues have been incorporated into a series of development alternatives. The following describes in detail the specific requirements considered in the development of the alternatives.

AIRFIELD ALTERNATIVES

Airfield facilities are, by nature, the focal point of the airport complex.

01MP17-4A-10/1/02

AIRFIELD CONSIDERATIONS

- Conform to ARC B-II Design Requirements
  - Remove buildings within Object Free Area (OFA), Obstacle Free Zone (OFZ), and F.A.R. Part 77 primary surface
- Provide an ultimate runway length of 4,800'
- Provide for a full-length parallel taxiway
- Provide for holding aprons at each runway end
- Provide for GPS approach to Runway 29
- Provide location for the development of an automated weather observation system (AWOS)

LANDSIDE CONSIDERATIONS

- Provide areas for new storage hangar development
- Provide an area for commercial general aviation development
- Provide for the relocation of hangars which are within the OFA, OFZ, and primary surface
- Provide an area for the development of a public terminal building
- Provide location for an aircraft wash rack
- Provide for expanded fuel storage, consider self-service fueling
- Provide for a helipad

San Manuel AIRPORT

Exhibit 4A
ALTERNATIVE
DEVELOPMENT CONSIDERATIONS

Because of their primary role and the fact that they physically dominate airport land use, airfield facility needs are often the most critical factor in the determination of viable airport development alternatives. In particular, the runway system requires the greatest commitment of land area and often imparts the greatest influence of the identification and development of other airport facilities. Furthermore, aircraft operations dictate the FAA and state design criteria that must be considered when looking at airfield improvements. These criteria, depending upon the areas around the airport, can often have a significant impact on the viability of various alternatives designed to meet airfield needs.

While not an obligated federal airport, the Arizona Department of Transportation (ADOT), Aeronautics Division requires that San Manuel Airport be built to Federal Aviation Administration (FAA) design standards. As mentioned previously in Chapter Three, the FAA bases the design of airfield facilities, in part, on the physical and operational characteristics of aircraft using the airport. The FAA utilizes the Airport Reference Code (ARC) system to relate airport design requirements to the physical (wingspan) and operational (approach speed) characteristics of the largest and fastest aircraft conducting 500 or more operations annually at the airport. While this can at times be represented by one specific make and model of aircraft, most often the airport's ARC is represented by several different aircraft which collectively conduct more than 500 annual operations at the airport.

The FAA uses the 500 annual operations threshold when evaluating the need to develop and/or upgrade airport facilities to ensure that an airport is cost-effectively constructed to meet the needs of those aircraft that are using, or have the potential to use, the airport on a regular basis. Typically, aircraft operate at an airport that are outside the ARC designated for the airport. This is due to these aircraft not meeting the 500 annual operations threshold.

At San Manuel Airport, based aircraft fall within ARC A-I and B-I. However, the mix of transient aircraft is more diverse and includes aircraft in ARC B-II. Aircraft in ARC B-II are the most demanding aircraft to operate at the airport (due to their longer wing spans); however, these aircraft currently conduct less than 500 annual operations at the airport. Therefore, at this time, the most demanding approach category for the airport is Approach Category B. The wingspans of the most demanding aircraft fall within Airplane Design Group (ADG) I.

The previous master plan called for the airport to be designed and constructed to ARC B-II design standards. This has been confirmed in this master plan. This master plan anticipates that aircraft with ARC B-II will conduct more than 500 annual operations at the airport within the planning period of this master plan. Therefore, the long term design requirement for San Manuel Airport is ARC B-II.

Table 4A compares existing (ARC B-I) and future (ARC B-II) design requirements. As shown in the table, applying ARC B-II design requirements increases both the pavement and safety area requirements. For example, the minimum pavement width increases from 60 feet to 75 feet and the distance that runway safety area (RSA) and object free area (OFA) extend beyond the runway end increases from 240 feet to 300 feet. The airside alternative analysis to follow examines the options available to meeting ARC B-II design requirements.

TABLE 4A
Runway Design Standards

Airport Reference Code Approach Visibility Minimums	B-I[1] One Mile	B-II One Mile
Runway		
Width	60	75
Runway Safety Area (RSA)		
Width (centered on runway centerline)	120	150
Length Beyond Runway End	240	300
Object Free Area (OFA)		
Width	250	500
Length Beyond Runway End	240	300
Obstacle Free Zone (OFZ)		
Width (centered on runway centerline)	250	400
Length Beyond Runway End	200	200
Runway Centerline to:		
Parallel Taxiway Centerline	225	240
Runway Protection Zones (RPZ)		
Inner Width	250	500
Outer Width	450	700
Length	1,000	1,000
FAR Part 77 Primary Surface		
Width (centered on runway centerline)	250	500
Length Beyond Runway End	200	200

[1] Small aircraft exclusively
Source: FAA Airport Design Software Version 4.2D, FAR Part 77

Of concern with meeting ARC B-II design requirements is the number of objects within the ARC B-II OFA. The FAA defines the OFA as "a two dimensional ground area surrounding runways, taxiways, and taxilanes which is clear of objects except for objects whose location is fixed by function (i.e. airfield lighting)." The limits of the OFA are shown by a pink solid line on **Exhibit 4B**. As shown on the exhibit, there are approximately four permanent facilities within the ARC B-II OFA. This includes a fuel pump, seven-unit T-hangar facility, public restroom facilities, and residence. To fully comply with ARC B-II OFA standards, these facilities should be removed and/or relocated. The relocation of the seven-unit T-hangar facility is considered in the landside alternatives, although the feasibility of doing so is not readily known. If the facilities cannot be efficiently relocated,

01MP17-4B-5/9/03

LEGEND

- Object Free Area (OFA)
- Taxiway OFA
- Obstacle Free Zone (OFZ)
- Runway Safety Area (RSA)
- Lease Boundary
- Ultimate Lease Boundary
- Runway Protection Zone (RPZ)
- Ultimate RPZ
- Ultimate Airfield Pavement
- Ultimate Roads
- Buildings to be Removed
- AWOS Siting Area
- AWOS

SUMMARY

1. Extend Runway 11-29 to 4,800, relocate waterlines, culvert wash
2. Remove buildings within ultimate OFA and primary surface
3. Widen parallel taxiway to 35 ft.
4. Extend parallel taxiway to each end
5. Add exit taxiway
6. Add non-precision markings

NORTH AWOS SITING AREA
AWOS ALT B
AWOS ALT A
HOLDING APRON
EXISTING WASH
EXISTING WATER LINES
240'
500'
400'
150'
586' EXTENSION
EXISTING 4,214' x 75'
ULTIMATE 4,800' x 75'
TAXIWAY OFA
RESTROOMS
HOLDING APRON
RESIDENCE
EXISTING ENTRANCE ROAD
SEVEN-UNIT T-HANGAR
FUEL PUMP
29
STORM WATER DRAINAGE SYSTEM
AWOS ALT C
SOUTH AWOS SITING AREA
REALIGNED ENTRANCE ROAD
RAILROAD TRACK
STATE HIGHWAY 76
NORTH
0
500
1000
SCALE IN FEET
San Manuel AIRPORT

Exhibit 4B
AIRFIELD ALTERNATIVES

planning would need to consider replacement facilities.

The requirements of the obstacle free zone (OFZ) must also be considered. The OFZ is a defined volume of airspace 400 feet wide, centered on the runway centerline, extending 200 feet beyond each runway end. FAA standards preclude any permanent development or taxiways within the OFZ. Objects which may only temporarily be located within the OFZ are also prohibited (e.g. a moving vehicle or parked aircraft). The OFZ is intended to protect an area for the operation of landing or departing aircraft and is shown by the orange dashed line on **Exhibit 4B**. The taxiway hold lines at the airport are placed to ensure aircraft hold outside the limits of the OFZ. The hold lines are presently marked 125 feet from the runway centerline. In the future, the hold lines would need to be situated 200 feet from the runway centerline to meet OFZ standards.

Presently, the area south of the seven-unit T-hangar facility is used for aircraft parking, aircraft refueling, and getting aircraft into and out of the T-hangars. Since the northern limits of the ultimate OFZ are only approximately 24 feet from the seven-unit T-hangar facility and 10 feet from the fuel pump, aircraft using these facilities would be within the limits of the ultimate OFZ. Therefore, the airport does not fully comply with OFZ standards. To ensure that the OFZ remains clear, the seven-unit T-hangar facility and fuel pump should be removed and/or relocated.

Obstacle clearance is further governed by Federal Aviation Regulation (FAR) Part 77, *Objects Affecting Navigable Airspace*. FAR Part 77 establishes the primary surface and transitional surface. The primary surface for San Manuel Airport would extend 250 feet either side of the runway centerline. Similar to the OFA and OFZ, the primary surface is to be clear of any objects other than objects that are fixed by function (e.g., runway edge lighting, approach lighting systems). The transitional surface extends upward and outward at a ratio of 7:1. The transitional surface begins at the edge of the primary surface. The same objects penetrating the ARC B-II OFA also penetrate the ultimate primary surface and transitional surface, and should ultimately be removed and/or relocated.

Compliance with OFZ standards is a requirement for the establishment of an instrument approach procedure. An instrument approach procedure is an important component of the overall safety and reliability of San Manuel Airport. Presently, San Manuel Airport does not have an established approach procedure. Without an approach procedure, the airport is effectively closed to arrivals during weather conditions when visual flight can no longer be conducted. With the need for the airport to support local economic growth, it is important that the airport is accessible during all weather conditions and that the amount of time the airport is inaccessible due to weather conditions is reduced. An instrument approach procedure is a tool

that increases the accessibility of the airport by providing procedures for pilots to locate the airport during poor weather conditions. The State Transportation Board Policy for the Aeronautics Division provides for the State Planning Standards for Airports in Arizona. These policies and standards call for the establishment of an instrument approach procedure at airports serving aircraft within ADG II, as planned for San Manuel Airport. The *Navigational Aids and Aviation Services Special Study* also called for the establishment of an instrument approach procedure at San Manuel Airport. Besides complying with OFZ standards, to qualify for a nonprecision instrument approach procedure, the Runway 11-29 markings would need to be upgraded from the existing basic/visual markings to nonprecision markings.

The parallel taxiway should ultimately be extended to each runway end and equipped with holding aprons. Appendix 16 of FAA Advisory Circular (AC) 150/5300-13 recommends a full-length parallel taxiway for airports served with a nonprecision instrument approach procedure. Furthermore, the State Planning Standards for Airports in Arizona recommends a parallel taxiway for ADG II airports. The parallel taxiway is mandatory when annual operations levels exceed 20,000. The airport is projected to exceed this level in the Long Term Planning Horizon.

Holding aprons provide an area at the runway end for aircraft to prepare for departure and/or bypass other aircraft which are ready for departure. When a holding apron cannot be developed, a bypass taxiway should be planned. This is a taxiway that lies parallel to the runway end taxiway and allows aircraft ready for departure to bypass aircraft that may be holding at the runway end. The location of holding aprons at San Manuel Airport are shown on **Exhibit 4B**.

Also shown on **Exhibit 4B**, the parallel taxiway extends almost the entire length of Runway 11-29. The parallel taxiway ends approximately 400 feet short of the Runway 29 end to avoid the existing hangar facilities, fuel pump, restrooms, and residence described previously. The taxiway extending to the Runway 29 end has been configured to ensure that aircraft remain clear of these existing facilities. Extending the parallel taxiway to the existing Runway 29 end also requires the relocation of the seven-unit T-hangar, fuel pump, restroom facilities, and residence.

Exhibit 4B depicts the development of a midfield exit taxiway. This taxiway would be 2,400 feet from each runway end and allow a greater number of landing aircraft the ability to exit the runway quicker by not having to taxi to the runway end to exit. **Exhibit 4B** also depicts the widening of the parallel taxiway to 35 feet to conform with ARC B-II width standards.

The runway length analysis in Chapter Three indicated a need for a longer runway for the projected mix of aircraft using San Manuel Airport. Presently, Runway 11-29 is 4,214 feet long. The analysis in Chapter Three indicates that a runway length of 4,800 feet is needed to serve the mix of aircraft

expected to use the airport through the planning period.

Three alternatives can be considered to provide additional runway length: 1) place the entire extension on the east (Runway 29) end; 2) place the entire extension on the west (Runway 11) end; or 3) divide the extension between each runway end. The distance the runway can be extended at either end is dependent upon the ability to meet safety area requirements at that end of the runway. In other words, the distance the runway can be extended is dependant upon the extent that a full RSA and OFA can be provided at the far end of the extension.

An extension to the Runway 29 end is limited by the location of a stormwater drainage system. As shown on **Exhibit 4B**, the existing OFA already extends to the limits of the stormwater drainage system. Therefore, the Runway 29 end cannot be extended any further without extending the OFA further into the stormwater drainage system. It is unlikely, then, that the Runway 29 end can be further extended to the east. This leaves the only viable extension option as extending the runway entirely to the west.

Exhibit 4B depicts a 586-foot extension of Runway 11-29 to the west for an ultimate length of 4,800 feet. An extension to the west was considered during the development of Runway 11-29 as the parallel taxiway presently extends beyond the Runway 11 end. Extending Runway 11-29 to the west would impact an existing wash and water lines. The wash would need to be placed in a culvert to direct the stormwater below the runway. The existing water lines would need to be relocated outside the limits of the OFA and RSA. This would also ensure that the water lines could be serviced without affecting airport operations.

Extending Runway 11-29 586 feet to the west would cause the Runway 11 RPZ to extend beyond the existing lease boundary. **Exhibit 4B** depicts the additional lease area that would need to be obtained to fully encompass the Runway 11 RPZ.

The facility requirements analysis determined that an automated weather observation system (AWOS) is needed at San Manuel Airport to provide important weather details to pilots, especially transient and charter aircraft operators (charter companies cannot operate to the airport without current weather data). An AWOS includes various sensors for recording cloud height, visibility, wind, temperature, dew point, and precipitation. The *Navigational Aids and Aviation Services Special Study* also called for installing an AWOS at San Manuel Airport.

FAA Order 6560.20A, *Siting Criteria For Automated Weather Observing Systems* (AWOS) provides AWOS siting requirements. While each AWOS sensor has specific siting requirements, all AWOS sensors should be located together and outside the runway and taxiway object free areas. Generally, AWOS sensors are best placed between 1,000 feet and 3,000 feet from the primary runway threshold and between 500 feet and 1,000 feet from the runway centerline. If the elevation of the sensor site is above or below the runway

elevation, the lateral distance from the runway centerline is adjusted by seven feet for every foot of elevation difference. The adjustment is negative (i.e., the minimum distance is less than 500 feet) if the sensor site elevation is less than the runway elevation. The adjustment is positive (i.e., the minimum distance is greater than 500 feet) if the sensor site elevation is greater than runway elevation.

Since Runway 29 is being designated for an instrument approach procedure, the AWOS is best placed near the Runway 29 end. The AWOS could be located on either the north or south sides of the runway. **Exhibit 4B** depicts the boundaries of an AWOS siting area on each side of Runway 11-29. As shown on the exhibit, following the general siting criteria above, the south siting area is completely outside the existing airport lease boundary. A portion of the north siting area extends over the existing lease area.

Generally, an area within a 500-foot radius of the AWOS is protected from development that could interfere with the sensing equipment. This protection area is shown on the exhibit and used to determine the potential location for the AWOS.

Exhibit 4B depicts three alternative siting locations. Alternative A locates a potential AWOS system on existing leased property west of the primary apron area. This location falls midway in the siting area. Since this location has been graded to a similar elevation of the runway, only small lateral adjustments to the sensors would be needed. The primary disadvantage of this site is that it is located within one of the primary developable parcels on the airport. The landside alternatives to follow examine developing this area to meet future hangar and/or apron demands. Placing the AWOS in this area could limit landside development.

Alternative B places a potential AWOS just inside the northern airport boundary. This area is generally below the runway elevation; therefore, a lateral adjustment towards the runway may be necessary. While the sensory equipment may be located on leased property, the protection area would extend outside the existing leased boundary. To fully protect the AWOS protection area, additional lease area may be needed.

Alternative C locates the AWOS in the south siting area, south of the stormwater drainage system. This area is completely outside the existing lease boundary and additional property would need to be leased to install this equipment and provide access to it.

LANDSIDE ALTERNATIVES

The primary landside facilities to be accommodated at the airport include airport-related businesses, public terminal facilities, aircraft storage hangars, and aircraft parking aprons. The interrelationship of these functions is important to defining a long range landside layout for the airport. To a certain extent, landside uses need to be grouped with similar uses or uses that are compatible. Other functions should be separated, or at least have well

defined boundaries, for reasons of safety, security, and efficient operation. Finally, each landside use must be planned in conjunction with the airfield, as well as ground access that is suitable to the function. Runway frontage should be reserved for those uses with a high level of airfield interface, or need for exposure. Other uses with lower levels of aircraft movements, or little need for runway exposure, can be planned in more isolated locations. The following briefly describes landside facility requirements.

Fixed Base Operator (FBO): This essentially relates to providing areas for the development of facilities associated with aviation businesses that require airfield access. This includes businesses involved with (but not limited to) aircraft rental and flight training, aircraft charters, aircraft maintenance, line service, and aircraft fueling. Businesses such as these are characterized by high levels of activity with a need for apron space for the storage and circulation of aircraft. In addition, the facilities commonly associated with businesses such as these include large, conventional type hangars which hold several aircraft plus attached office and business space. Utility services are needed for these types of facilities as well as automobile parking areas. The alternatives consider the potential for two to three 10,000 square-foot hangars for future FBO activities. Presently, there are no such facilities available at San Manuel Airport.

Terminal Building: General aviation terminal facilities have several functions including: providing space for passenger waiting, a pilot's lounge, flight planning, concessions, airport management, storage, and various other needs. Utility services are needed for this type of facility as well as automobile parking areas. Terminal buildings are best placed along the apron for ease of access to aircraft. There is no terminal building at San Manuel Airport, although a small building near the fuel pump provides restroom facilities. The State Planning Standards for Airports in Arizona states that, at a minimum, the following terminal services should be provided at an airport: telephone, access to weather data, a waiting area, restroom facilities, portable fire extinguishers, and posted local procedures/emergency procedures. While terminal services can be provided in a separate dedicated building, they can also be incorporated into larger FBO hangars. The alternatives consider a separate dedicated building for this purpose at San Manuel Airport.

Aircraft Storage Hangars: This includes a wide variety of hangar facilities, such as: T-hangars, shade T-hangars, and small conventional hangar designs. The facility needs analysis indicated a need for enclosed T-hangars and executive/individual hangars at the airport. T-hangars are characterized by a series of smaller hangars within a larger contiguous building. Executive/individual hangars are smaller conventional hangars that accommodate one or more small aircraft. Unlike FBO hangars, these hangars are typically smaller, encompassing only approximately 3,600 square feet or less. Since these facilities are utilized only for aircraft storage, they typically have lower levels of

activity than hangar facilities associated with FBO operations. Therefore, these facilities can be constructed along taxiways. These facilities do not require a location along runway frontage. Utility services are needed for these types of facilities as well as automobile parking areas.

Fuel Storage and Dispensing: The facility requirements analysis indicated a need for expanded fuel storage at San Manuel Airport. Presently, a single 2,000-gallon above-ground storage tank is used for 100LL fuel storage. Typically, fuel storage totals 10,000 gallons to 12,000 gallons to ensure a full tanker load of fuel (approximately 8,000 gallons) can be delivered. This ensures the most competitive fuel prices. In the future, Jet-A fuel storage may be needed as well.

Besides considering expanded fuel storage, fuel dispensing options must be considered. Presently, fuel is dispensed through a fixed pump located near the Runway 29 end. This is the most cost-effective option of dispensing fuel since mobile fuel trucks are not required to bring the fuel to an aircraft. Fixed dispensing islands also allow for a self-service option, which can allow for after-hours fueling and reduce labor costs. Under this option, pilots could refuel their own aircraft using a credit card. The primary disadvantage of a fixed fuel island is the area that the island occupies and the need to locate the fuel storage tanks in close proximity to the fuel island. Additional aircraft handling is also required to position the aircraft at the fuel island for refueling. With mobile fuel trucks, the fuel storage tanks can be remotely located.

Helipad: A helipad is being considered to provide a marked and segregated landing and takeoff area for helicopters.

Wash Rack: An aircraft wash rack provides a suitable area for the cleaning of an aircraft's exterior. The wash rack provides for the proper disposal of aircraft cleaning fluids. There is no such facility currently available at the airport.

Vehicle Access: For safety and security, vehicle access areas and aircraft movement areas should be segregated. This is particularly important for areas requiring public access, such as FBO facilities. FBO facilities require access from a variety of users (i.e., delivery vehicles, charter passengers, etc.), some which are not familiar with operating at an airport environment. Therefore, these facilities cannot be accessed using a taxiway or crossing an apron area. FAA AC 150/5210-20, *Ground Vehicle Operations on Airports*, states: "The control of vehicular activity on the airside of an airport is of the highest importance." The AC further states: "An airport operator should limit vehicle operations on the movement areas of the airport to only those vehicles necessary to support the operational activity of the airport." For the alternatives analysis, vehicular access to storage hangars will be considered that does not require the aircraft owner to cross an apron or taxiway area.

Consideration for a new main entrance road should be considered. Presently, access to the airport is via a 1.3 mile unpaved (yet graded) road from Highway 76. This roadway is located

on BHP Billiton-owned land. While current planning includes paving this road, an alternate connection to Highway 76 should be considered. **Exhibit 4B** depicts a connection with Highway 76 directly south of the airport. As shown on the exhibit, the existing airport road could be extended south to Highway 76. This roadway would extend approxi-mately 1,600 feet south of the existing entrance road intersection at the airport lease boundary. Of concern is the need to cross the BHP Billiton-owned railroad track. This track is in limited use (approximately one train per day). Safety barriers may need to be considered.

Finally, consideration must be given to providing for the relocation of the seven-unit T-hangar facility that is within the limits of the ARC B-II OFA. The other facilities within the OFA are considered to be removed and not replaced on airport property as they are not an aviation-related use (residence) or of little value due to their size, age, and condition.

To a certain extent, landside uses should be grouped with similar uses or uses that are compatible. Other functions should be separated, or at least have well defined boundaries, for reasons of safety, security, and efficient operation. Finally, each landside use must be planned in conjunction with the airfield, as well as ground access that is suitable to the function.

The landside alternatives are limited to the area north of Runway 5-23. This area is within the existing lease boundaries of the airport and has been initially developed to accommodate landside development needs. The area south of Runway 11-29 is outside the existing lease boundary. Airfield access to this area is complicated by the location of the stormwater drainage system. Airfield access would require bridging or constructing a culvert to allow for continued stormwater drainage. Impacts on stormwater flows would need to be considered prior to developing the area south of the runway. Furthermore, the area south of Runway 11-29 is not expected to be needed to accommodate projected landside growth in the planning period of this master plan. As the landside alternatives to follow will show, ample area exists north of Runway 11-29 to accommodate projected long term growth for San Manuel Airport.

The existing terrain features should be considered in the long term landside layout. The terrain north of Runway 11-29 is a lower elevation from the runway, generally declining towards the airport lease boundary. The area surrounding the main apron area has been filled and graded; however, additional fill to the east may be needed to accommodate future development in this area.

LANDSIDE ALTERNATIVE A

Landside Alternative A is shown on **Exhibit 4C**. The intent of this alternative is to segregate aircraft storage, commercial general aviation services, and transient uses at the airport, to the extent practicable. In this alternative, a public terminal building is constructed on the existing

01MP17-4C-10/2/02

RELOCATED SEGMENTED CIRCLE/ WIND CONE

RELOCATED HANGARS

ADG II TIEDOWNS

ADG I TIEDOWNS

EXISTING SEGMENTED CIRCLE/ WIND CONE

240'

150'

400'

500'

29

NORTH

0 200 400

SCALE IN FEET

LEGEND

- Object Free Area (OFA)
- Obstacle Free Zone (OFZ)
- Runway Safety Area (RSA)
- Building Restriction Line (BRL)
- Lease Boundary
- Runway Protection Zone (RPZ)
- Ultimate Airfield Pavement
- Ultimate Buildings
- Ultimate Roads and Parking
- Buildings to be Removed

FACILITY LEGEND

1. Commerical FBO Hangar
2. Public Terminal
3. Wash Rack
4. Fuel Storage
5. Executive/Individual Hangar
6. Helipad
7. T-Hangar
8. Self-Service Fuel Island

San Manuel AIRPORT

Exhibit 4C
LANDSIDE ALTERNATIVE A

apron area. Two 10,000-gallon to 12,000-gallon fuel storage tanks are located west of the terminal. A fixed fuel island is located on the apron near the terminal building for ease of access by the fuel provider. This fuel island could be configured for self-service fueling. The fuel island is connected to the fuel storage tanks through underground piping. An aircraft wash rack is located at the west end of the existing apron area. The east end of the apron is reserved for small conventional hangar development. These hangars could either serve commercial FBO services or for aircraft storage. A new exit taxiway is shown on the east end of the apron.

The existing apron is also expanded approximately 20 feet north. This ensures that any future development on the north side of the apron is located at a sufficient lateral distance from the existing marked taxilane. Vehicle access and parking is available from an extended airport entrance road that is moved along the northern lease boundary.

Large commercial FBO facilities are reserved for the area west of the existing paved apron area. This apron area is configured for both small aircraft tiedowns (ADG I tiedowns) and large aircraft tiedowns (ADG II tiedowns). The large FBO hangars are developed on the north side of the apron with adjacent automobile parking.

To accommodate a proposed helipad and T-hangar development, the existing segmented circle and lighted wind cone are relocated to the west. The helipad is developed east of the existing apron area, 500 feet from the runway centerline consistent with standards set forth in FAA AC 150/5390-2B, *Heliport Design*. The helipad is designed according to the standards in the AC to accommodate helicopters with rotor diameters to 50 feet.

The first row of T-hangars is reserved for the relocated seven-unit T-hangar facility and existing individual hangar located north of the runway. To the east of the relocated T-hangars are three rows of eight-unit nested T-hangars. Automobile parking for the hangars is reserved along the airport entrance road. At the east end of the runway, area is reserved for the development of nine executive hangars. Each hangar is served by dedicated automobile parking areas.

This alternative does not allow for the development of a holding apron at the Runway 29 end as previously shown on **Exhibit 4A**. The holding apron would interfere with taxiway development for the executive hangars.

Advantages: This alternative exceeds projected long term landside facility needs. This alternative provides for a wide variety of hangar types and uses. This alternative provides for the relocation of existing facilities that are located within the ARC B-II OFA. This alternative allows for self-service fueling.

Disadvantages: This alternative requires significant new taxiway development for T-hangar and executive hangar development. Large amounts of fill may be necessary to develop the T-hangar and executive hangars.

Taxiway development is required prior to the relocation of the existing seven-unit T-hangar. A holding apron is not provided at the Runway 29 end.

LANDSIDE ALTERNATIVE B

Landside Alternative B is shown on **Exhibit 4D**. This alternative attempts to maximize the existing graded area around the main apron for near-term development needs. These needs could include the relocation of the seven-unit T-hangar, development of a public terminal building, wash rack, T-hangars, and an FBO hangar. As shown on the exhibit, the existing seven-unit T-hangar facility would be relocated to the northern side of the apron. This is consistent with the previous master plan that had planned for T-hangar development along the northern side of the apron. A public terminal building and FBO hangar are developed to the east. The wash rack is developed on the west side of the existing apron.

Fuel storage is located off the apron area to the east. This location is near the entrance road for ease of fuel delivery. Locating the fuel storage off the apron area allows for more hangar development along the apron frontage. However, this option relies on mobile fuel delivery vehicles to get fuel to the aircraft.

Long term FBO hangar development is reserved for an area east of the existing apron. This includes an expanded apron area to serve both large and small aircraft tiedowns. This would eventually require the relocation of the existing segmented circle and wind cone to the west. A helipad is developed to the east. To ensure sufficient area is available on the north side of the existing apron for large FBO hangar development, the access road is developed to the north of the existing airport lease boundary. Additional lease area would be needed to develop the road as shown.

A helipad is developed to the east of the expanded apron area. This requires the relocation of an existing hangar that is moved to the northern edge of the main apron. This location provides maximum segregation from the apron area for helicopter activities.

T-hangar and executive hangar development is reserved for the area west of the existing apron area. This layout accommodates 24 T-hangars and 36,000 square feet of executive hangar area.

Advantages: This alternative exceeds projected long term landside facility needs. This alternative provides for a wide variety of hangar types and uses. This alternative provides for the relocation of existing facilities that are located within the ARC B-II OFA. This alternative maximizes development around the existing apron area and graded area west of this apron area prior to new apron and taxiway development.

Disadvantages: This alternative does not allow for self-service fueling. Additional lease area is needed for the proposed roadway alignment.

01MP17-4D-10/2/02

RELOCATED SEGMENTED CIRCLE/ WIND CONE

RELOCATED HANGARS

ADG I TIEDOWNS

ADG II TIEDOWNS

ADG I TIEDOWNS

HOLDING APRON

EXISTING SEGMENTED CIRCLE/ WIND CONE

240'

150'

400'

500'

29

NORTH

0 200 400

SCALE IN FEET

LEGEND

- Object Free Area (OFA)
- Obstacle Free Zone (OFZ)
- Runway Safety Area (RSA)
- Building Restriction Line (BRL)
- Lease Boundary
- Ultimate Lease Boundary
- Runway Protection Zone (RPZ)
- Ultimate Airfield Pavement
- Ultimate Buildings
- Ultimate Roads and Parking
- Buildings to be Removed

FACILITY LEGEND

1. Commerical FBO Hangar
2. Public Terminal
3. Wash Rack
4. Fuel Storage
5. Executive/Individual Hangar
6. Helipad
7. T-Hangar

San Manuel AIRPORT

Exhibit 4D
LANDSIDE ALTERNATIVE B

LANDSIDE ALTERNATIVE C

Landside Alternative C is shown on **Exhibit 4E**. Similar to Landside Alternative B, this alternative attempts to maximize development around the existing apron area and utilize the existing graded area for near term development. In this alternative, the seven-unit T-hangar facility is relocated to the west edge of the existing apron area and situated in a north-south alignment. An additional 10-unit nested T-hangar facility could be developed to the west without additional grading or fill. The north portion of the apron is reserved for FBO development, the public terminal, and fuel storage. In this alternative, a fixed fuel island would be located adjacent to the fuel storage tanks, which could be configured for self-service fueling. As needed for demand, the existing apron is expanded to the east to accommodate both small and large aircraft tiedowns. Prior to apron development, the aircraft wash rack could be developed in the graded area currently occupied by the segmented circle and wind cone. The segmented circle and wind cone are relocated to the east.

Executive hangar development is reserved for an area east of the main apron. This configuration may limit the amount of grading and fill necessary to develop taxiway access to the runway, as the taxiway leading to the hangars would be developed to follow the existing grade down to the level where the hangars would be built. The nine executive hangars would be served by automobile parking and access.

Advantages: This alternative exceeds projected long term landside facility needs. This alternative provides for a wide variety of hangar types and uses. This alternative provides for the relocation of existing facilities that are located within the ARC B-II OFA. This alternative allows for self-service fueling.

Disadvantages: A holding apron is not provided at the Runway 29 end.

SUMMARY

The process utilized in assessing the airside and landside development alternatives involved a detailed analysis of short and long term requirements as well as future growth potential. Current airport design standards were considered at each stage of development.

Upon review of this report by Pinal County and the Planning Advisory Committee, a final master plan concept can be formed. The resultant plan will represent an airside facility that fulfills safety and design standards and a landside complex that can be developed as demand dictates.

The proposed development plan for the airport must represent a means by which the airport can grow in a balanced manner, both on the airside as well as the landside, to accommodate forecast demand. In addition, it must provide (as all good development plans should) for flexibility in the plan to meet activity growth beyond the 20-year planning period.

01MP17-4E-10/2/02

RELOCATED HANGARS

RELOCATED SEGMENTED CIRCLE/ WIND CONE

ADG II TIEDOWNS

ADG I TIEDOWNS

ADG I TIEDOWNS

EXISTING SEGMENTED CIRCLE/ WIND CONE

240'

150'

400'

500'

N

NORTH

0 200 400

SCALE IN FEET

LEGEND

- Object Free Area (OFA)
- Obstacle Free Zone (OFZ)
- Runway Safety Area (RSA)
- Building Restriction Line (BRL)
- Lease Boundary
- Runway Protection Zone (RPZ)
- Ultimate Airfield Pavement
- Ultimate Buildings
- Ultimate Roads and Parking
- Buildings to be Removed

FACILITY LEGEND

1. Commerical FBO Hangar
2. Public Terminal
3. Wash Rack
4. Fuel Storage
5. Executive/Individual Hangar
6. Helipad
7. T-Hangar
8. Self-Service Fuel Island

San Manuel AIRPORT

Exhibit 4E
LANDSIDE ALTERNATIVE C

The remaining chapters will be dedicated to refining the basic concept into a final plan with recommendations to ensure proper implementation and timing for a demand-based program.